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Species

Jurassica zeylonensis et sp. novus: a angiosperm's ancestor from the Jurassic beds of Tabbowa, Sri Lanka

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ABSTRACT

The well known Jurassic macro flora from Tabbowa basin of Sri Lanka continues to yield a new incomplete taxon. This paper reports on a new type of fertile shoot consisting with a possible reproductive or flower-like organ at the end of short stalk among the long stalked falcate (tongue shaped) leaves. The affinity of this species remains unclear, it may be affiliated to gymnosperms or early angiosperm but no similar species or organs reported in the literature from elsewhere. Therefore, the newly found fossil differs from known Mesozoic fertile fronds. Some morphological details of the specimen are presented and the new taxon, *Jurassica zeylonensis* Dharma & Geetha. sp.nov. is proposed.

Keywords: Jurassic flora, gymnosperm, reproductive organ, flower-like structure, Sri Lanka

Abbreviations*:* Sp. – Species, nov. – Novus

Fossil: A remnant or impression of a prehistoric organism of a past geological age, preserved in petrified form or as a mold or cast in rock.

Gymnosperm: A group of vascular, seed-bearing plants but not angiosperm whose seeds are not enclosed in an ovary but the ovules are exposed or naked on the surface of the megasporophylls or similar structures. In addition to several extinct groups, there are four very divers living angiosperm phyla include conifers, cycads, ginkgo and gnetophytes.

1. INTRODUCTION

The fossil flora from Jurassic sedimentary rocks of Tabbowa, Sri Lanka first reported by Sitholey in 1942 and the age of the flora is reported as Late Jurassic or Early Cretaceous. The material described here is a shoot found among the fossils of Ferns, Pteridosperms, cycads and predominantly of Bennettitales assemblages; *Taeniopteris, Ptilophyllum and Zamite* found in Tabbowa.

2. SCOPE OF THE STUDY

The objective of this paper is to report a discovery of a well preserved fossil with its unique features, and assigning a true systematic position in the plant world.

2.1. Methodology

This study is based on observations on plant specimen found in Tabbowa as impression on mudstone that are deposited in a faulted basin within the Precambrian crystalline rock terrain of Sri Lanka. In the study area, sedimentary rocks are of limited extent and scattered and exposed on surface only at few places. The sedimentary rocks are identified as shallow water deposits laid down in a rapidly subsiding or brackish water delta (Cooray, 1984).

Collected fossil specimen was studied under reflecting light microscope and photographed using light filters to enhance contrast using low angle lighting to reveal surface details (Edirisooriya and Dharmagunawardhane, 2012). The studied material is kept in the Herbarium, Department of Royal Botanical Garden, Peradeniya, Sri Lanka (PDA – Holotypus), Sri Lanka.

2.2. Geological Background

Jurassic beds of Tabbowa spreads over few square kilometres on a flat and slightly undulating landscape in the North-western province of the country. The beds include a series of sandstone, feldspathic sandstone, siltstone, and mudstone scattered with occasional thin bands of nodular limestone deposited in a basin formed by faulting in the Precambrian crystalline basement (Cooray, 1984). As far as the geological structure is concerned, the Tabbowa beds are well bedded (Fig.1) and jointed with variable strike and dips. The variations of the dips are reported to be due to local faulting within the basin and consequent tilting (Cooray, 1984). Plant fossils exit only in the mudstone and siltstone (Edirisooriya and Dharmagunawardhane, 2012).

3.0. SYSTEMATIC PALAEOBOTANY

Division: Gymnospermae
Order: Coniferales
Family: Arucariacea
Genus: Insertae sedis
Species: Insertae sedis
Etymology: The generic name refers to the palaeo age: Jurassic
Species: Species name refers to the / country locality: Sri Lanka
Type species: ***Jurassica zeylonensis*** Dharma & Geetha sp.nov. (Fig. 2A-2C)

3.1. Species Diagnosis

Small, single, un-branched fragmented shoot. The Leaves heteromorphic. One set of leaves linear, lanceolate, and thick with rounded apex, bases constricted and spirally arranged on the shoot. Leaves are attached to the shoot by their entire width of the base and also de-current down below the level of insertion to the shoot. Venation and Mid-rib are not visible.

The other type of (two) leaves dissimilar in size, falcate or tongue shaped, attached to the main shoot by its long, slender stalk. Between these two leaves occurs an immature bud or flower-like part attaching to the end of a stalk. This flower-like part is appeared as a compound oval shaped head with partially fused scale type leaves.
Preserved In : Ferruginous Mudstone

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Figure 1

Sample Location: Jurassic - rock beds near a surface water pond in the study area

Angiosperm: A plant group whose ovules are enclosed in a ovary within the flower, which develops into a fruit after fertilization.

Jurassic Period: Jurassic is a geologic time according to the Earth science or Geological science which denoted or formed or rock series or sedimentary deposits of the second period of the Mesozoic era, between the Triassic and Cretaceous periods in which dinosaurs continued to be the dominant land fauna and the earliest birds appeared, lasting for 55 million years from 190 to 136 My before present.

Locality : Tabbowa, Northwestern Province, Puttlum District, Sri Lanka
Repository: Herbarium, Department of Royal Botanical Garden, Peradeniya, Sri Lanka (PDA – holotypus), January 2013.
Age : Early to Mid Jurassic
Material Examined: one specimen (Fig. 2A-2C)

3.2. Description

A single un-branched shoot, well preserved with prominent, flat and linear leaves. The length of the shoot is 18.0 mm and the width ranges from 3.2 mm - 6.3 mm, the width decreases towards the shoot's apex.

Leaf arrangement is spiral and arises from the shoot at an angle of about 45^0. Leaf base is de-current and attached by entire width of the leaf base. Angle of leaf attachment is variable probably taken place during preservation. Leaf shape is typically falcate, linear lanceolate and flattened. Leaves are heteromorphic. Leaf blade is thick, broad and free. Leaf margins are entire to cuneate. The apex is rounded or sub acute. Venations are not visible.

A slender, simple, thin, long stalk-like branch arises and divided into two small branchlets in the middle region of the specimen. Tongue shaped leaves are present at the edge of these branchlets curving towards the centre of each leaf. The flower-like structure or the immature bud is present between the two leaves on a short stalk-like branchlet attached to the base of large leaf. As shown in Fig 2A-2C the size of the flower-like structure or immature bud, size is 1.5 mm to 2.0 mm in height, and 0.3 mm in width and only one structure is available or could be seen for the specimen.

4. DISCUSSION

4.1. Fossil Evidence for Resemblance to Arucarites

The present specimen has some significant characteristic features which suggest that it has a affinity with arucariaceae. Heteromorphic leaves (Niklas et al, 1983) of the present specimen are a common feature in arucariaceae family.

4.2. Fossil Evidence Resemblance to Angiosperm

Wide-ranging details of past literature on Mesozoic angiosperms are recorded by Dilcher (1979), Friis et al (2006). The earliest evidences and some of the hypothesis suggested for the first, Bennettitales and / or Gnetales and / or Conifers as the precursor to early angiosperms (Qui et al, 1999, Soltis et al 1999, Miller, 2009). This was based on the facts such as the flower-like structure showy, bisexual, reproductive organs, herbaceous or woody shrubs with similar to woody anatomy and spirally arranged simple leaves, fruits and pollens (Crane, 1985, Crane and Dilcher, 1984). Then the late Jurassic fossil plant had a reproductive organ with large bracts equivalent to petals in an angiosperm flower and the positioned of the organ at the end of the branch (Dilcher, 1987, Niklas et al, 1983), all these features are the key characters of early angiosperms (Krassilov, 1997). These characters are clearly visible in the present specimen. Neither venation patterns could be observed nor has spore or pollen been found so far. Therefore, further details are not available on the material discovered.

The newly discovered fossil specimen exhibit a number of vegetative and reproductive morphological features that are intermediate between arucariaceae and early angiosperm. Evidence from the geological records suggests that the angiosperm first appeared approximately 140 million years ago in the early cretaceous period (Cameron, 2007, Scott, 1998). If the specimen is of angiosperm, the first appearance of the angiosperm may date back to early Mesozoic.

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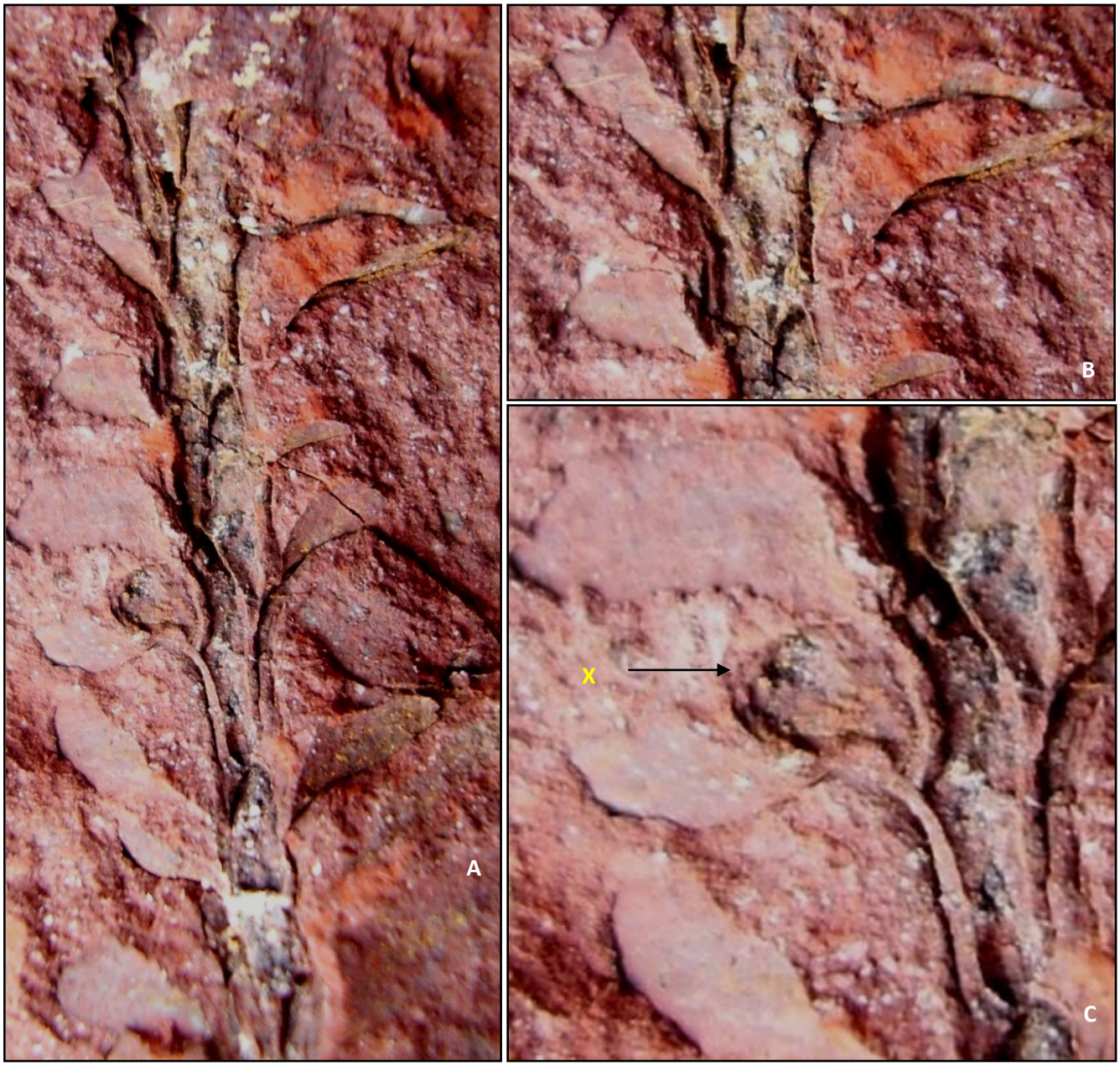

Figure 2

Jurassica zeylonensis new species found from Tabbowa Jurassic beds: A) Fragment of complete specimen of new plant species showing leaves, reproductive structure, B) Close up photograph of upper part of the specimen, C) Close up photograph of middle part of the specimen highlighting the reproductive structure or flower-like structure or immature bud, (X) among the two different sizes leaves.

5. CONCLUSION

The systematic attribution of the new taxon possesses features of a fertile shoot of arucariaceae and/or of early angiosperm group. The fossil flora discussed in this study, from Sri Lanka is unique and does not totally resemble with any plant group described in the literature. Therefore, we propose a new name as, ***Jurassica zeylonensis*** Dharma *&* Geetha. sp. nov. for the new taxon. A systematic placement of *Jurassica zeylonensis* sp. is still kept open because in the absence of complete martial and or microspores, also foliage details such as venation pattern and cuticle feature could not be observed in the present specimen. Since co-occurring fossil assemblages of the same location are of lower Jurassic age, if the specimen resembles angiosperm, the first appearance of flowering plants may date back to early Mesozoic.

SUMMARY OF RESEARCH

1 This Work provided **t**he systematic attribution of the new taxon that possesses features of a fertile shoo, for assigning a true systematic position in the plant world.
2 Propose a new name for new taxon as, ***Jurassica zeylonensis*** Dharma *&* Geetha. sp. nov. Fig 2A-2C
3 **C**o-occurring fossil assemblages of the same location are of lower Jurassic age. If the specimen resembles angiosperm, the first appearance of flowering plants may date back to early Mesozoic.

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FUTURE ISSUES

From the findings**,** a systematic placement of *Jurassica zeylonensis* sp. provides specific details of the new taxon. However, in the absence of complete martial, microspores, foliage details etc. it is kept open for contributions from the future investigators.

DISCLOSURE STATEMENT

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